[redacted] No.: 043888-0403

IAP3 Rec'd PCT/PTO 31 JAN 2006 PCT #

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of

Tsumoru OHATA, et al.

Application No.: 10/551,934

Filed: October 04, 2005

Customer Number: 20277

Confirmation Number: 6449

Group Art Unit: Not yet assigned

Examiner: Not yet assigned

For: LITHIUM ION SECONDARY BATTERY

Mail Stop Petition
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

Transmitted herewith is a Preliminary Amendment in the above-identified application.

☐ No additional fee is required.
☐ Applicant is entitled to small entity status under 37 CFR 1.27
☒ Also attached: PETITION TO MAKE SPECIAL UNDER 37 CFR § 1.102(d)

The fee has been calculated as shown below:

[redacted]	NO. OF CLAIMS	HIGHEST PREVIOUSLY PAID FOR	EXTRA CLAIMS	RATE	FEE
Total Claims	27	20	7	$50.00 =	$350.00
Independent Claims	4	3	1	$200.00 =	$200.00
		Multiple dependent claims newly presented			$0.00
		Fee for extension of time			$0.00
		PETITION TO MAKE SPECIAL UNDER 37 CFR § 1.102(d)			$130.00
		Total of Above Calculations			$680.00

☒ Please charge my Deposit Account No. 500417 in the amount of $680.00. An additional copy of this transmittal sheet is submitted herewith.

☒ The Commissioner is hereby authorized to charge payment of any fees associated with this communication or credit any overpayment, to Deposit Account No. 500417, including any filing fees under 37 CFR 1.16 for presentation of extra claims and any patent application processing fees under 37 CFR 1.17.

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01 FC:1615 350.00 DA
02 FC:1614 200.00 DA

Respectfully submitted,

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Please recognize our Customer No. 20277 as our correspondence address.

Docket No.: 043888-0403 **PATENT**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of	:	Customer Number: 20277
Tsumoru OHATA, et al.	:	Confirmation Number: 6449
Application No.: 10/551,934	:	Group Art Unit: Not yet assigned
Filed: October 04, 2005	:	Examiner: Not yet assigned
For: LITHIUM ION SECONDARY BATTERY	:	

PETITION TO MAKE SPECIAL UNDER 37 CFR § 1.102(d)

Mail Stop Petition
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Applicants hereby petition to make special the above-identified application in accordance with 37 C.F.R. § 1.102(d). Pursuant to MPEP § 708.02(VIII), Applicant complies with each of the following items:

A. FEE

Please charge Deposit Account 500417 the amount of $130.00 as set forth in 37 C.F.R. § 1.17(h) to cover the fee for the present Petition to Make Special.

B. SINGLE INVENTION

If the Office determines that all the claims presented are not obviously directed to a single invention, Applicants will make an election without traverse and hereby invites

the Examiner to telephone the undersigned Applicants' representative for a telephonic election.

C. PRE-EXAMINATION SEARCH

Applicants submit that a search was made by a foreign patent office in connection with PCT/JP2004/010994 of which the present application claims priority under 35 U.S.C. §371. A copy of the International Search Report was filed with an IDS on October 4, 2005.

D. COPY OF THE REFERENCES

Each of the references have been previously cited on an IDS filed on October 4, 2005 and provided to the USPTO via the international searching authority (ISA). These references are:

U.S. Pat. No. 5,882,721;

U.S. Pat. No. 5,948,464;

U.S. Pat. No. 6,558,840;

U.S. Pat. Pub. No. 2004/0115523;

U.S. Pat. Pub. No. 2003/0118896;

Japanese Patent Application Laid Open Pub. No. JP 10-055718;

Japanese Patent Application Laid Open Pub. No. JP 10-106530;

Japanese Patent Application Laid Open Pub. No. JP 07-220759;

Japanese Patent Application Laid Open Pub. No. JP 2002-541632;

Japanese Patent Application Laid Open Pub. No. JP 2004-273437;

Japanese Patent Application Laid Open Pub. No. JP 10-241656;

Japanese Patent Application Laid Open Pub. No. JP 2002-279956;

Japanese Patent Application Laid Open Pub. No. JP 10-223195;

Japanese Patent Application Laid Open Pub. No. JP 2002-319386;

Japanese Patent Application Laid Open Pub. No. JP 2000-195492; and

Japanese Patent Application Laid Open Pub. No. JP 2000-195491.

E. DETAILED DISCUSSION

Present Invention

The present invention relates to a lithium ion secondary battery.

Claims 1 has been amended, claims 2-4, 6, 8-12, and 15 canceled, and new claims 16-37 have been added by preliminary amendment. Claim 1 recites:

> 1. A lithium ion secondary battery comprising:
> a positive electrode capable of absorbing and desorbing lithium ion;
> a negative electrode capable of absorbing and desorbing lithium ion;
> a porous film interposed between said positive electrode and said negative electrode; and
> a non-aqueous electrolyte;
> wherein said porous film is adhered to a surface of at least one of said positive electrode and said negative electrode,
> said porous film comprises a filler and a resin binder,
> a content of said resin binder in said porous film is 1.5 to 8 parts by weight per 100 parts by weight of said filler, and
> said resin binder comprises core-shell type rubber particles, and
> said rubber particles have an adhesive surface portion including at least an acrylonitrile unit, an acrylate unit, or a methacrylate unit.

Claim 16 recites:

> 16. A lithium ion secondary battery comprising:
> a positive electrode capable of absorbing and desorbing lithium ion;
> a negative electrode capable of absorbing and desorbing lithium ion;
> a porous film interposed between said positive electrode and said negative electrode; and

a non-aqueous electrolyte;

wherein said porous film is adhered to a surface of at least one of said positive electrode and said negative electrode,

said porous film comprises a filler and a resin binder,

a content of said resin binder in said porous film is 1.5 to 8 parts by weight per 100 parts by weight of said filler,

said resin binder at least includes an acrylonitrile unit, an acrylate unit, or a methacrylate unit, and

an average pore size of micropores in said porous film obtained by a Bubble-point method is 0.02 to 0.09 μm.

Claim 21 recites:

21. A lithium ion secondary battery comprising:

a positive electrode capable of absorbing and desorbing lithium ion;

a negative electrode capable of absorbing and desorbing lithium ion;

a porous film interposed between said positive electrode and said negative electrode; and

a non-aqueous electrolyte;

wherein said porous film is adhered to a surface of at least one of said positive electrode and said negative electrode,

said porous film comprises a filler and a resin binder,

a content of said resin binder in said porous film is 1.5 to 8 parts by weight per 100 parts by weight of said filler,

said resin binder at least includes an acrylonitrile unit, an acrylate unit, or a methacrylate unit, and

an elongating percentage of said porous film is 15% or more.

Claim 27 recites:

27. A lithium ion secondary battery comprising:

a positive electrode capable of absorbing and desorbing lithium ion;

a negative electrode capable of absorbing and desorbing lithium ion;

a porous film interposed between said positive electrode and said negative electrode; and

a non-aqueous electrolyte;

wherein said porous film is adhered to a surface of at least one of said positive electrode and said negative electrode,

said porous film comprises a filler and a resin binder,

a content of said resin binder in said porous film is 1.5 to 8 parts by weight per 100 parts by weight of said filler, and

an amount of said resin binder is smaller in a first surface side where said porous film is in contact with said surface of said electrode, and larger in a second surface side opposite to said first surface side.

Lithium ion secondary batteries according to the present invention require a porous film comprising a resin and a binder, wherein the resin binder comprises core-shell type rubber particles, the rubber particles having an adhesive surface portion including at least an acrylonitrile unit, an acrylate unit, or a methacrylate unit, as in the embodiment of claim 1; that the average pore size of micropores in the porous film obtained by a bubble point method is 0.02 to 0.09 μm, as in the embodiment of claim 16; an elongating percentage of the porous film is 15% or more, as in the embodiment of claim 21; and that an amount of the resin binder is smaller in a first side in contact with the surface of the electrode, and larger in a second surface side opposite to the first electrode side, as in the embodiment of claim 27.

An object of the present invention is to provide a lithium ion secondary battery which can achieve both safety and high-rate characteristics, with a usage of a porous film which can secure heat resistance, necessary strength, and lithium ion conductivity by limiting a resin binder content in the porous film to a small amount, while selecting a constituent monomer of the resin binder. Another object of the present invention is to improve lithium ion conductivity of the porous film by controlling the average pore size of micropores in the porous film. Another object of the present invention is to improve reliability of a battery by controlling the elongating percentage of the porous film. Another object of the present invention is to suppress an internal short circuit due to occurrence of material mixture separation in the manufacturing processes with a usage of the porous film while maintaining discharge characteristics of a battery, by controlling a distribution state of the resin binder in the thickness direction of the porous film. (*See* pages 4-6 of the written description.)

Discussion Of Prior Art

JP 2002-541632, U.S. Pat. No. 6,558,840 and JP 2004-273,437 were cited by the Examiner in PCT/JP2004/010994 and the relevance of the prior art was denoted in the international search report ISA/210. New claims 16-37 are directed towards embodiments presented in the original claims. JP 2002-541632, U.S. Pat. No. 6,558,840 have been indicated to be relevant to all the original claims. JP 2004-273437 has been indicated to be relevant to originally filed claims 1-3, 7-9 and 13-25.

Comparison with U.S. Pat. No. 5,882,721

The `721 patent is directed toward a method of forming a porous composite separator layer comprising the steps of printing a thin layer of a separator precursor solution on the surface of an electrochemical electrode. The `721 patent, however, does not suggest a porous film comprising a resin and a binder, wherein the resin binder comprising core-shell type rubber particles, the rubber particles having an adhesive surface portion including at least an acrylonitrile unit, an acrylate unit, or a methacrylate unit; that the average pore size of micropores in the porous film obtained by a bubble point method is 0.02 to 0.09 μm; an elongating percentage of the porous film is 15% or more; and that an amount of the resin binder is smaller in a first side in contact with the surface of the electrode, and larger in a second surface side opposite to the first electrode side.

Comparison with U.S. Pat. No. 5,948,464

The `464 patent is directed toward a method of forming a porous composite separator layer comprising the steps of printing a thin layer of a separator precursor solution on the surface of an electrochemical electrode. The `464 patent, however, does

not suggest a porous film comprising a resin and a binder, wherein the resin binder comprises core-shell type rubber particles, the rubber particles having an adhesive surface portion including at least an acrylonitrile unit, an acrylate unit, or a methacrylate unit; that the average pore size of micropores in the porous film obtained by a bubble point method is 0.02 to 0.09 μm; an elongating percentage of the porous film is 15% or more; and that an amount of the resin binder is smaller in a first side in contact with the surface of the electrode, and larger in a second surface side opposite to the first electrode side.

Comparison with JP 2002-541632 and U.S. Pat. No. 6,558,840

JP '632 and the `840 patent are directed toward an electrode for use in a non-aqueous battery, which electrode comprises at least a microporous sheet, consisting of inorganic, optionally electroconductive particle, a polymer having a high molecular weight, and a hydrocarbon-containing compound. JP `632 and the `840 patent, however, do not suggest a porous film comprising a resin and a binder, wherein the resin binder comprises core-shell type rubber particles, the rubber particles having an adhesive surface portion including at least an acrylonitrile unit, an acrylate unit, or a methacrylate unit; that the average pore size of micropores in the porous film obtained by a bubble point method is 0.02 to 0.09 μm; an elongating percentage of the porous film is 15% or more; and that an amount of the resin binder is smaller in a first side in contact with the surface of the electrode, and larger in a second surface side opposite to the first electrode side.

Comparison with U.S. Pat. Pub. No. 2004/0115523

The `523 publication is directed to a nonaqueous battery having a spirally coiled electrode body having a separator comprising three or more layers of microporous film made of laminated polyolefin, wherein at least one of the inner layers is made of porous

polyethylene. The `523 publication, however, does not suggest a porous film comprising a resin and a binder, wherein the resin binder comprises core-shell type rubber particles, the rubber particles having an adhesive surface portion including at least an acrylonitrile unit, an acrylate unit, or a methacrylate unit; that the average pore size of micropores in the porous film obtained by a bubble point method is 0.02 to 0.09 μm; an elongating percentage of the porous film is 15% or more; and that an amount of the resin binder is smaller in a first side in contact with the surface of the electrode, and larger in a second surface side opposite to the first electrode side.

Comparison with U.S. Pat. Pub. No. 2003/0118896

The `896 publication is directed to a nonaqueous battery having a spirally coiled electrode body having a separator comprising a plurality of microporous films. The `896 publication, however, does not suggest a porous film comprising a resin and a binder, wherein the resin binder comprises core-shell type rubber particles, the rubber particles having an adhesive surface portion including at least an acrylonitrile unit, an acrylate unit, or a methacrylate unit; that the average pore size of micropores in the porous film obtained by a bubble point method is 0.02 to 0.09 μm; an elongating percentage of the porous film is 15% or more; and that an amount of the resin binder is smaller in a first side in contact with the surface of the electrode, and larger in a second surface side opposite to the first electrode side.

Comparison with JP 10-055718

The JP `718 abstract is directed to a paste electrolyte for an electrochemical cell. The JP `718 abstract, however, does not suggest a porous film comprising a resin and a binder, wherein the resin binder comprises core-shell type rubber particles, the rubber

particles having an adhesive surface portion including at least an acrylonitrile unit, an acrylate unit, or a methacrylate unit; that the average pore size of micropores in the porous film obtained by a bubble point method is 0.02 to 0.09 μm; an elongating percentage of the porous film is 15% or more; and that an amount of the resin binder is smaller in a first side in contact with the surface of the electrode, and larger in a second surface side opposite to the first electrode side.

Comparison with JP 10-106530

The JP `530 abstract is directed to a fine porous composite separator which is printed on an electrode . The JP `530 abstract, however, does not suggest a porous film comprising a resin and a binder, wherein the resin binder comprises core-shell type rubber particles, the rubber particles having an adhesive surface portion including at least an acrylonitrile unit, an acrylate unit, or a methacrylate unit; that the average pore size of micropores in the porous film obtained by a bubble point method is 0.02 to 0.09 μm; an elongating percentage of the porous film is 15% or more; and that an amount of the resin binder is smaller in a first side in contact with the surface of the electrode, and larger in a second surface side opposite to the first electrode side.

Comparison with JP 07-220759

The JP `759 abstract is directed to a nonaqueous electrolyte secondary battery comprising a porous protecting film of a specific thickness in a surface of any active material applied layer. The JP `759 abstract, however, does not suggest a porous film comprising a resin and a binder, wherein the resin binder comprises core-shell type rubber particles, the rubber particles having an adhesive surface portion including at least an acrylonitrile unit, an acrylate unit, or a methacrylate unit; that the average pore size of

micropores in the porous film obtained by a bubble point method is 0.02 to 0.09 μm; an elongating percentage of the porous film is 15% or more; and that an amount of the resin binder is smaller in a first side in contact with the surface of the electrode, and larger in a second surface side opposite to the first electrode side.

Comparison with JP 2004-273437

The JP '437 abstract is directed to a lithium ion secondary battery comprising a porous film containing solid fine particles and a complex binder, the complex binder consists of a main binder made of polyethersulfone and a sub binder made of polyvinyl pyrrolidone. The JP '437 abstract, however, does not suggest a porous film comprising a resin and a binder, wherein the resin binder comprises core-shell type rubber particles, the rubber particles having an adhesive surface portion including at least an acrylonitrile unit, an acrylate unit, or a methacrylate unit; that the average pore size of micropores in the porous film obtained by a bubble point method is 0.02 to 0.09 μm; an elongating percentage of the porous film is 15% or more; and that an amount of the resin binder is smaller in a first side in contact with the surface of the electrode, and larger in a second surface side opposite to the first electrode side.

Comparison with JP 10-241656

The JP '656 abstract is directed to a battery comprising a separator consisting of an insulation material particle aggregated layer in which insulation substance particles are coupled with a binder is fixed to active material layers of an electrode. The JP '656 abstract, however, does not suggest a porous film comprising a resin and a binder, wherein the resin binder comprises core-shell type rubber particles, the rubber particles having an adhesive surface portion including at least an acrylonitrile unit, an acrylate

unit, or a methacrylate unit; that the average pore size of micropores in the porous film obtained by a bubble point method is 0.02 to 0.09 μm; an elongating percentage of the porous film is 15% or more; and that an amount of the resin binder is smaller in a first side in contact with the surface of the electrode, and larger in a second surface side opposite to the first electrode side.

Comparison with JP10-223195

The JP '195 abstract is directed to a positive electrode active material formed on current collector foil for forming an aggregate layer of the insulating material grains functioning as a separator to obtain a positive electrode, and an aggregate layer of the insulating material grains integrated on the surface of the positive electrode to obtain the separator. The JP '195 abstract, however, does not suggest a porous film comprising a resin and a binder, wherein the resin binder comprises core-shell type rubber particles, the rubber particles having an adhesive surface portion including at least an acrylonitrile unit, an acrylate unit, or a methacrylate unit; that the average pore size of micropores in the porous film obtained by a bubble point method is 0.02 to 0.09 μm; an elongating percentage of the porous film is 15% or more; and that an amount of the resin binder is smaller in a first side in contact with the surface of the electrode, and larger in a second surface side opposite to the first electrode side.

Comparison with JP 2002-279956

The JP '956 abstract is directed to a nonaqueous electrolyte battery with a separator comprising two layers of fine porous membrane, and the average diameter of the fine porous membrane on the positive electrode side is set to be larger than the average pore diameter of the fine porous membrane on the negative electrode side. The

JP `956 abstract, however, does not suggest a porous film comprising a resin and a binder, wherein the resin binder comprises core-shell type rubber particles, the rubber particles having an adhesive surface portion including at least an acrylonitrile unit, an acrylate unit, or a methacrylate unit; that the average pore size of micropores in the porous film obtained by a bubble point method is 0.02 to 0.09 μm; an elongating percentage of the porous film is 15% or more; and that an amount of the resin binder is smaller in a first side in contact with the surface of the electrode, and larger in a second surface side opposite to the first electrode side.

Comparison with JP 2002-319386

The JP `386 abstract is directed to a nonaqueous electrolyte secondary battery with a separator comprising a plurality of layers of microporous materials. At least two of the layers having different porosities, and an average pore diameter of the micropores in the layer of the highest porosity out of the layers different in porosities is larger than an average pore diameter of the micropores in the layer of the lowest porosity. The JP `386 abstract, however, does not suggest a porous film comprising a resin and a binder, wherein the resin binder comprises core-shell type rubber particles, the rubber particles having an adhesive surface portion including at least an acrylonitrile unit, an acrylate unit, or a methacrylate unit; that the average pore size of micropores in the porous film obtained by a bubble point method is 0.02 to 0.09 μm; an elongating percentage of the porous film is 15% or more; and that an amount of the resin binder is smaller in a first side in contact with the surface of the electrode, and larger in a second surface side opposite to the first electrode side.

Comparison with JP 2000-195492

The JP '492 abstract is directed to a battery separator containing a polymer, a plasticizer, and an insulating filler. The JP '492 abstract, however, does not suggest a porous film comprising a resin and a binder, wherein the resin binder comprises core-shell type rubber particles, the rubber particles having an adhesive surface portion including at least an acrylonitrile unit, an acrylate unit, or a methacrylate unit; that the average pore size of micropores in the porous film obtained by a bubble point method is 0.02 to 0.09 μm; an elongating percentage of the porous film is 15% or more; and that an amount of the resin binder is smaller in a first side in contact with the surface of the electrode, and larger in a second surface side opposite to the first electrode side.

Comparison with JP 2000-195491

The JP '491 abstract is directed to a battery separator containing a polymer, a plasticizer, and an insulating filler. The JP '491 abstract, however, does not suggest a porous film comprising a resin and a binder, wherein the resin binder comprises core-shell type rubber particles, the rubber particles having an adhesive surface portion including at least an acrylonitrile unit, an acrylate unit, or a methacrylate unit; that the average pore size of micropores in the porous film obtained by a bubble point method is 0.02 to 0.09 μm; an elongating percentage of the porous film is 15% or more; and that an amount of the resin binder is smaller in a first side in contact with the surface of the electrode, and larger in a second surface side opposite to the first electrode side.

F. CONCLUSION

In view of the above, it is urged that the petition to make special is in proper form, and an indication of grant is respectfully solicited.

To the extent necessary, a petition for an extension of time under 37 C.F.R. § 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 500417 and please credit any excess fees to such deposit account.

Respectfully submitted,

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